



**May 15, 1945.**

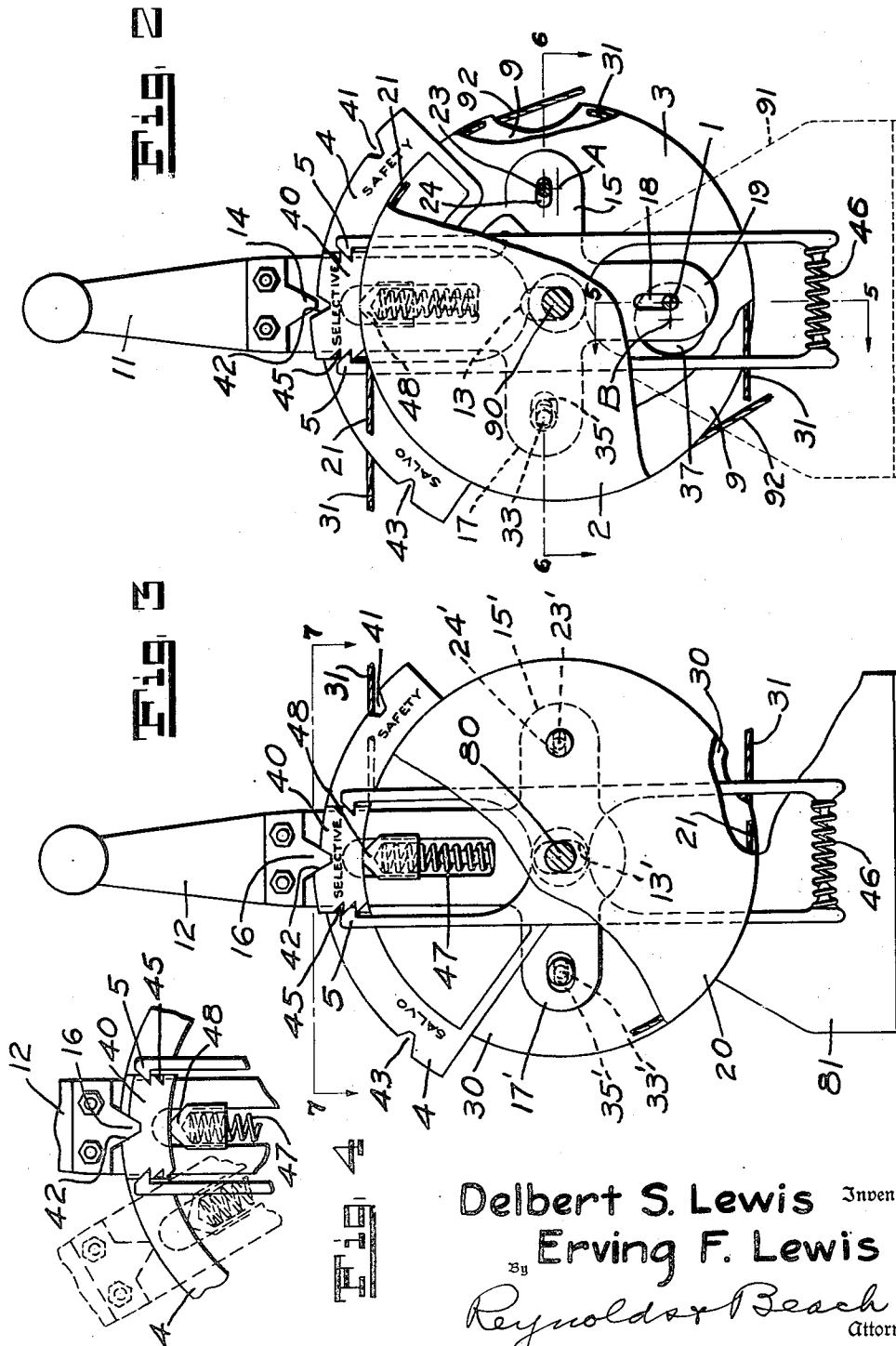
D. S. LEWIS ET AL

**2,376,157**

## INTERCONNECTED BOMB RACK CONTROL

Filed July 26, 1943

4 Sheets-Sheet 2



May 15, 1945.

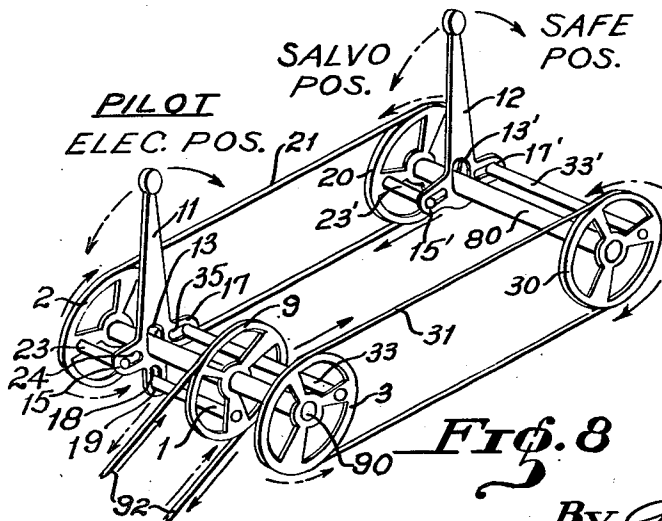
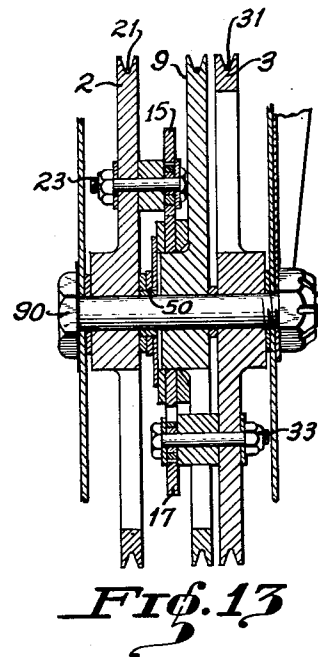
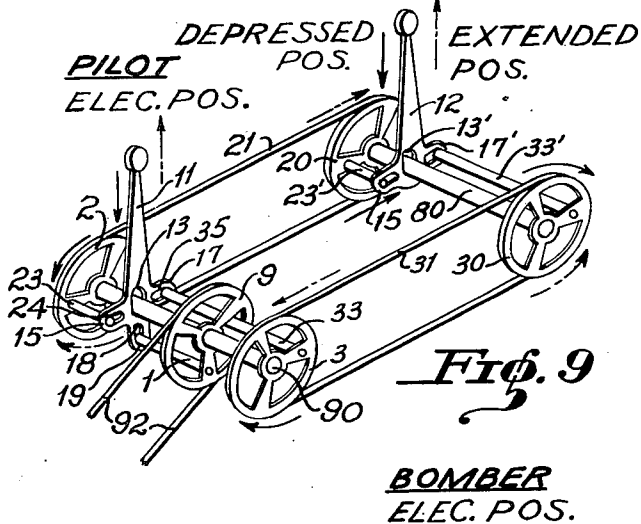
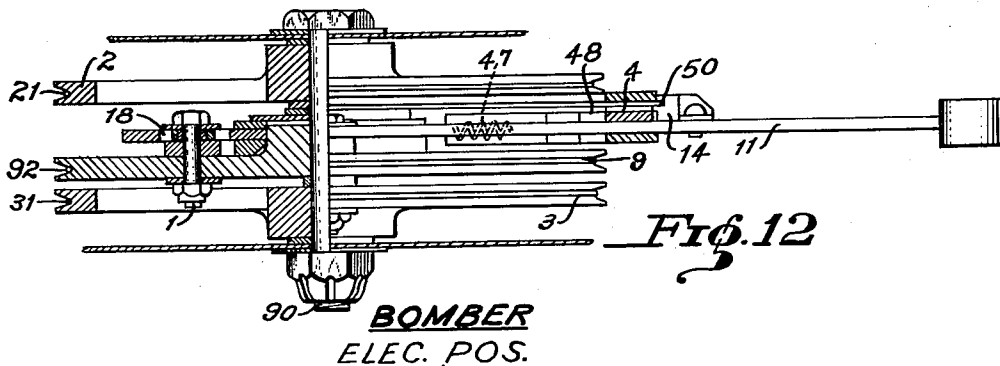
D. S. LEWIS ET AL

2,376,157

INTERCONNECTED BOMB RACK CONTROL

Filed July 26, 1943

4 Sheets-Sheet 3



Inventors:  
DELBERT S. LEWIS  
ERVING F. LEWIS

By *Reynolds & Beach*  
Attorneys.

May 15, 1945.

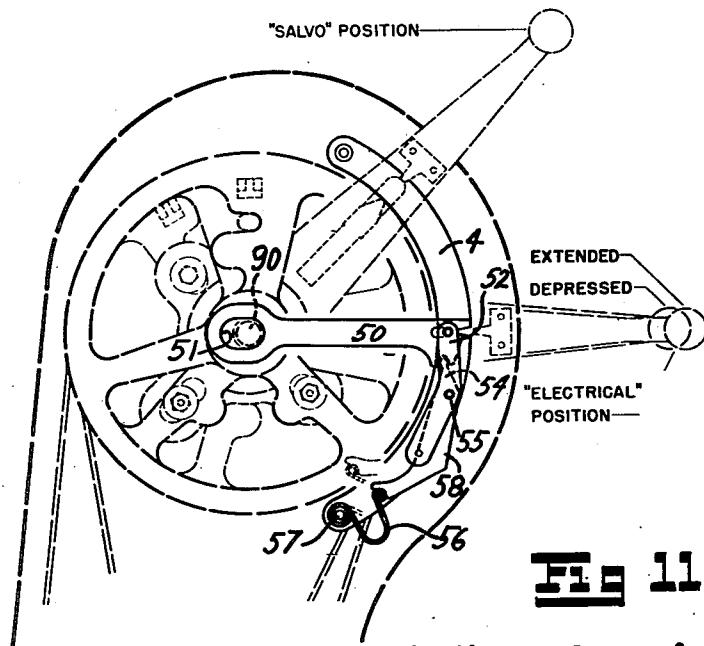
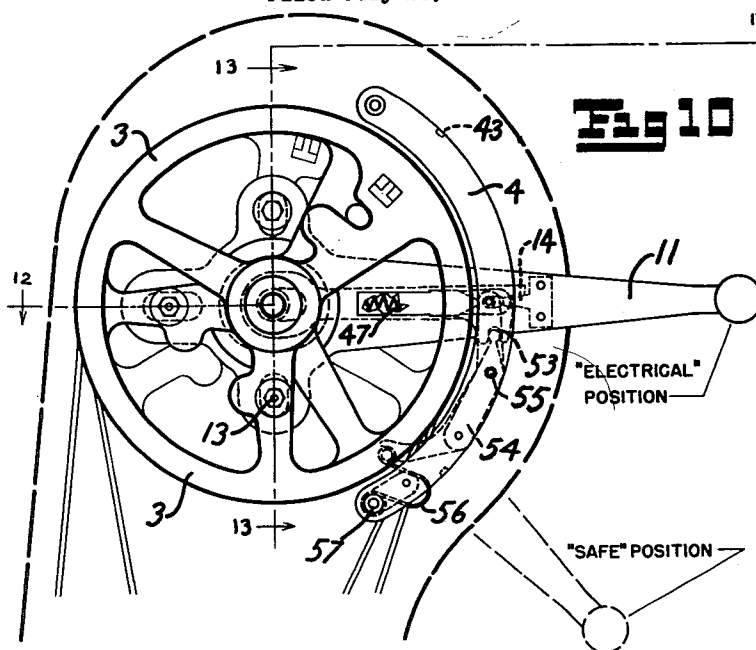
D. S. LEWIS ET AL

2,376,157

INTERCONNECTED BOMB RACK CONTROL

Filed July 26, 1943

4 Sheets-Sheet 4



Delbert S. Lewis  
Erving F. Lewis

Inventors

By *Reynolds & Beach*

Attorneys

## UNITED STATES PATENT OFFICE

2,376,157

## INTERCONNECTED BOMB RACK CONTROLS

Delbert S. Lewis and Erving F. Lewis, Seattle,  
Wash., assignors to Boeing Aircraft Company,  
Seattle, Wash., a corporation of Washington

Application July 26, 1943, Serial No. 496,112

16 Claims. (Cl. 74-479)

This invention concerns actuating mechanism for duplicating at one station movement initiated at a second station, and for effecting novel operations at one of such stations. It is applicable, for example, to a bomb rack installation, controllable from any one of two or more stations, as the bomber's and the pilot's stations. The operation may involve merely conditioning of the bomb racks for release, or the actual release of of the bombs therefrom, or it may combine these two functions. This application is a continuation in part of our application Serial No. 425,660, filed January 5, 1942, for Interconnected bomb rack controls.

The primary object of this invention is so to interconnect such spaced-apart controls that any movement of any one control will be immediately reflected in identical and simultaneous movement of the other control or controls. Each such control normally incorporates a stop upstanding in the path of the bomb rack control lever, to prevent movement of the latter uninterruptedly from "safe" position to "salvo" position, and which requires the bomb rack control lever to stop in the "selective" position. Since some different movement of the control lever, for instance depression, is required before it can be moved thence to "salvo" position, it is an essential in such interconnecting means to provide for transmission from one station to all others, not only of the normal rotary movement of the bomb rack control lever, but also of the depressing movement. The lock at one station then may not block the movement of the bomb rack control lever at another station, and all such locks are moved aside when one is so moved.

A further object is to provide for a control station, considered separately from the others, stop mechanism which may be moved into inoperative position easily, but by actuation of the control lever in a manner different from bomb release movement, and to return the stop automatically, or by a simple separate operation, to operative position again.

With these and other objects in mind, as will be clear from this description as it progresses, our invention comprises the novel parts, and the novel combination and arrangement of them, as shown in the accompanying drawings, described in this specification, and as will be more particularly defined by the claims.

In the accompanying drawings our invention is illustrated in typical arrangements, though it will be understood that many changes may be made in the specific form, character, and rela-

tionship of parts without departing from the spirit of this invention.

Figure 1 is an elevation of the control at one such station, which may be considered the pilot's station, with parts in the "safe" position.

Figure 2 is a similar view, with parts broken away, and showing parts just prior to settling in "selective" position.

Figure 3 is a view similar to Figure 2, but showing a companion station, for instance the bomber's station, and with parts settled into "selective" position.

Figure 4 is a detail showing the relative position of parts, following movement from the positions of Figures 2 and 3, in initiating movement toward "salvo" position.

Figure 5 is a detail section on line 5-5 of Figure 2, Figure 6 is a section on line 6-6 of Figure 2, and Figure 7 is a section substantially on the line 7-7 of Figure 3.

Figure 8 is a diagrammatic perspective view illustrating the manner in which swinging movement of the controls for bomb releasing operation is transmitted from one station to another, and Figure 9 is a similar diagrammatic view illustrating transmission of lengthwise stop releasing movement of one lever to another.

Figure 10 is an elevation view of control mechanism incorporating a different type of stop structure, and Figure 11 is a view of such stop mechanism in full lines, with the other parts illustrated in phantom.

Figure 12 is a side elevation view, showing parts in section, on line 12-12 of Figure 10, and Figure 13 is a further sectional view taken on line 13-13 of Figure 10.

As an illustrative application of our mechanism, it can well be understood that it is desirable to provide a means whereby, in addition to the bomber, the pilot of a bombing airplane can, on occasion, drop bombs. It is particularly desirable that the pilot have within his power the ability to drop bombs by salvo, for in an emergency, of which only the pilot may be aware, it may be necessary to drop all the bombs immediately in order to lighten the airplane. Nevertheless it is highly important that the controls be such that the bombs can never be accidentally salvo-released, and hence it is necessary to provide a stop which will prevent the bomb rack control lever or release lever from moving past the "selective" or "electrical" position from the "safe" position and towards the "salvo" position without stopping at the "selective" or some other intermediate position. A movement or action to

release the stop different from that occurring during progression from the "safe" to the "selective" position is required before the lever may continue and complete its progress toward "salvo" position. At the same time, if two or more stations are interconnected, and each has a stop or lock, the release of the stop at one station must also accomplish release of the locks at all other stations.

The operation of the bomb rack control lever ordinarily involves primarily a translational or swinging movement transversely of its length, but for the purpose of avoiding or releasing the lock it may involve a radial or depressing movement in the direction of its length. As has already been pointed out, it is immaterial whether the lever, so moved, be merely a lever to condition the bomb rack for release by other means, or whether it be in part or wholly the device which accomplishes the actual release of the bombs. It may, and in the present instance is intended to, partake of the nature of each such device, that is, when moved into "selective" or "electrical" position it merely conditions the bomb rack for release by the normal firing key, but when moved to "salvo" position it may operate, through mechanism not herein illustrated, to effect actual salvo release of the bombs.

Figure 1 and Figure 2 represent the pilot's control (though it might equally be the bomber's control or a control at some other station) in two different positions, and Figure 3 represents an interconnected station, as the bomber's control, in a position nearly but not quite corresponding to that of Figure 2. The principal difference between the installations at the two stations is that the actuator pulley 9 need be provided only at one such station, and is shown at the pilot's station. It is supported for rotation about a shaft 90, which supports it in a bracket 81. The actuator pulley 9 is suitably connected, as by a cable 92, to the bomb rack (not shown). At the other station or stations no such actuator pulley is provided, but a similar shaft designated 80, to distinguish it, is supported in a bracket 81.

At the pilot's station (Figures 1 and 2) a bomb rack control lever 11 is provided, which is longitudinally slotted, as indicated at 13, to straddle the shaft 90, and to permit movement of the lever 11 transversely of the axis of this shaft. The lever also rotates about the shaft. A similar lever 12 at the bomber's station (Figure 3) is similarly slotted, as indicated at 13', for similar movement with respect to its shaft 80. The lever 11 has oppositely directed arms 15 and 17, and the lever 12 has similar arms 15' and 17'. In addition the lever 11 is provided with an arm 9, extending opposite its handle. The lever 12 does not require a corresponding arm.

At the pilot's station, mounted for rotation about the shaft 90, are two pulleys 2 and 3. In the assembly as shown the lever 11 is intermediate the pulleys 2 and 3, and the actuator pulley is behind the pulley 3 (see Figures 5 and 6). In the diagrammatic Figures 8 and 9, illustrating the operation, it has been more convenient to show the pulley 9 interposed between the lever 11 and pulley 3, but the location of pulley 9 is merely a matter of choice. At the bomber's station there is a similar arrangement, pulleys 20 and 30 corresponding to the pulleys 2 and 3. Indeed, the pulleys 2 and 20 are connected for continued rotary movement by the cable 21, and the pulleys 3 and 30 are similarly connected by the cable 31.

The lever 11 is connected to rotate the actuator pulley 9 by means of the pin 1, which passes through a large hole 37 in the pulley 3, if such pulley is intermediate the lever and pulley 9. The pin 1 is received in a slot 18 in the arm 19 of the lever 11, which slot is parallel to the slot 13, to afford radial movement of the lever without interrupting the rotary connection between the lever 11 and the actuator 9.

In addition the lever 11 is connected by a pin 23 to the pulley 2, which pin is received within a slot 24 in the arm 15, and is also connected by a pin 33 to the pulley 3, which pin 33 is similarly received in a slot 35 in the arm 17. At the bomber's station a similar pin 23' in a slot in the arm 15', and a similar pin 33' in a slot in the arm 17', serve to connect the lever 12 with the pulleys 20 and 30, respectively.

It may now be seen, as indicated in Figure 8, that pure rotary or swinging movement of the lever 11, for instance, transversely of its length will effect corresponding rotary movement of the actuator pulley 9 and of the release operating pulleys 2 and 3 at this station, and since the pulleys 20 and 30 at the bomber's station are connected directly with the similar pulleys 2 and 3 respectively at the pilot's station through transmission cables 21 and 31, they, too, will rotate in the same manner and to the same degree, and will effect simultaneous swinging of the lever 12. In similar fashion, pure rotation of the lever 12 transversely of its length will effect swinging of the lever 11 at the pilot's station, and of the actuator 9. Furthermore, if the lever 11 is moved radially in the direction of its length, for instance from its position of Figure 9 downwardly, the center of the pin 23 will move downwardly to the point indicated at A, and will accomplish limited rotation of the pulley 2. At the same time such depression of the lever 11 will effect downward movement of the pin 33 and corresponding limited rotation of the pulley 3, to which the pin 33 is connected, but in the opposite sense.

In this fashion the pulleys 2 and 3 are moved to a limited degree, but reversely to one another, about the shaft 90. Since these pulleys at the pilot's station are connected to identical pulleys 20 and 30 at the bomber's station such movement at the one station will effect like pulley rotation at the other station, as illustrated in Figure 9, and this like movement, acting reversely through the pins 23' and 33' connected to the respective pulleys 20 and 30, will draw the lever 12 downwardly, in precisely the same manner, simultaneously with, and to the same extent that the lever 11 was moved downwardly. Conversely, if it is the lever 12 which initiated downward movement, the lever 11 will be caused to follow, and to move identically. This action is employed to effect simultaneous disengagement of both levers from the stops provided to prevent continued movement of either lever past "selective" position to "salvo" position.

The pins 23 and 33 are disposed at opposite sides of the shaft 90, in a line which approximately coincides with a diameter through the shaft. The line joining these pins preferably includes the center of the slot 13, so that this line coincides with the shaft's axis only when the lever 11 is in its neutral position assumed when the lever is set in one of its three notch held positions. When the lever is depressed to its lower limit, depressing thereby its arms 15 and 17 and the corresponding pins 23 and 33, it effects a shift of the pulley 3, for instance, so that the center of its large hole 37

shifts from B (Figure 2) to the opposite side of the axis of the pin 1. It is to permit such movements of pulley 3 with respect to pin 1 which passes through it, that the hole 37 is made large.

The lever 11 is provided with an abutment 14, and the lever 12 with a similar abutment 16. A quadrant 4 is provided at each station, having a notch 41 representing the "safety" position, a notch 43 representing the "salvo" position, and a slide 40 is provided with an upstanding stop shoulder leading to another notch 42, representing the "selective" or "electrical" position. The slide 40 is guided in the quadrant 4 for radial movement, and is provided with ratchet teeth 45, with which dogs 5, pivoted upon the shaft 90 or 80 and urged together by a spring 46, engage to hold the slide 40 in its inwardly depressed position, when moved thereto by a depressing action of the lever 11 or 12 in the direction of its length. A spring 47, bearing upon the lever 11 or 12 and upon the under side of the quadrant 4 through a follower 48, tends to urge the abutment 14 or 16, as the case may be, into the respective notches of the quadrant, and the radial movement of the lever thus required is permitted by the slots at 13 and at 18.

Assuming now that the lever 11 (or 12) is in the "safety" position, as shown in Figure 1, and it is desired to effect selective release of bombs, it is only necessary to move the lever radially outward in the direction of its length to withdraw abutment 14 from notch 41 and then to swing the lever to the "selective" or "electrical" position of Figure 2. It may be released in such position when its abutment 14 (or 16) will seat in the notch 42, as in Figure 3, and then the bombs can be released selectively by the normal electric selective release means, separate from this control. Such movement of the lever 11 effects corresponding movement of the lever 12, for as it is pulled radially outward to the extended position of Figure 9, the pulleys 2 and 20 will be rotated slightly in the sense opposite the rotation of pulleys 3 and 30 to effect lengthwise reciprocation of the lever 12, and thereafter swinging of lever 11 will rotate pulleys 2 and 3, and hence pulleys 20 and 30, in the same sense to swing lever 12 into the "selective" or "electrical" position. However, if it is desired to effect salvo release, the stop shoulder of slide 40 blocks further movement of the lever 11, for despite its radial lengthwise movement into extended position abutment 14 will not pass the portion of slide 40 between "selective" and "salvo" positions. The shaft 90 bottoms in the slot 13, preventing the lever being pulled outwardly far enough to pass the stop shoulder, as is clear from Figure 2, so that it can only swing to the left if the slide 40 is depressed.

This slide can be depressed, however, by radial inward movement of the lever 11 in the direction of its length, which engages the dogs 5 with the top ratchet teeth to hold the slide 40 depressed, as it is in full lines in Figure 4. Such reciprocation of the lever 11 to the depressed position of Figure 9 rotates pulleys 2 and 3 oppositely in the direction indicated by the full line arrows in Figure 9, and simultaneously rotates pulleys 20 and 30 in corresponding directions. Not only is the stop slide 40 with which the lever 11 is engaged moved inward, but lever 12, simultaneously moved to depressed position by the corresponding opposite rotation of pulleys 20 and 30, moves its slide 40 inward to its inner position where it is held by dogs 5 cooperating therewith.

After both slides have thus been depressed to move their stop shoulders inward to the general level of their respective quadrants 4, if the lever 11 or 12, as the case may be, is drawn outwardly lengthwise its abutment 14 or 16 will pass beyond the stop shoulder of its slide 40, as well as the outer periphery of the quadrant 4, slide 40 being retained in the inner position of Fig. 4 by dogs 5. Such movement of either lever into extended position will rotate its pulleys in opposite directions, but reversely to the rotative directions in which they moved during depression of the lever, as illustrated by the dot-dash line arrows in Figure 9. Both levers will therefore be moved outward simultaneously, and when thus extended they may be swung toward "salvo" position, as shown in dash lines in Figure 4. This movement of the actuated lever will, of course, rotate all the pulleys 2, 3, 20 and 30 in the same sense as indicated by the dot-dash line arrows in Figure 8.

Both levers are thus swung entirely over to the "salvo" position. Normally this will effect salvo release of all the bombs. The stop slide 40, however, has sufficiently interrupted the movement of the levers from "safe" to "salvo" position that this cannot be accomplished accidentally, but must be effected intentionally because of the double lengthwise reciprocation of the levers required.

After the bombs have thus been dropped, either lever may again be moved into extended position to withdraw the abutment 14 from notch 43, whereupon such lever may be swung back to the "selective" position and thence to the "safe" position. Corresponding movement of the other lever will, of course, be effected simultaneously. Engagement of the dogs 5 with each slide 40 maintains it in the inner position to enable the lever abutment to pass the slide during such swinging. After the levers have been swung back to "selective" position each slide 40 may be returned to its outer position. Such slide resetting may be accomplished by squeezing toward each other the ends of the dog arms 5 between which spring 46 is interengaged, to swing the opposite ends of such arms away from each other and out of contact with the interposed slide 40, and one of the levers, thus disposed in "selective" position, may then be drawn lengthwise outward to move the slide outward again to the position shown in Figure 1. All other levers will be moved correspondingly and simultaneously by such lever movement, but only the slides whose dogs 5 are thus disengaged by such movement of their dog arms will be reset. Upon release of pressure on the dog arms the slide will once more be held in a position such as shown in Fig. 3 interdicting movement of the associated lever beyond "selective" position toward "salvo" position. Each slide may thus be reset individually, or as many may be reset simultaneously as are released from their respective dogs.

The modified construction shown in Figures 10 to 13, inclusive, transmits motion of one lever to the other in the same manner as in the modification previously described. The parts are similarly numbered and it is unnecessary to repeat the description of the operation. As has been noted, however, the stop slide 40 at each station had to be reset separately, no mechanism being provided for transmitting such resetting movement from one station to another. In the modified form resetting mechanism for the safety stop slide is illustrated which is actuated auto-

matically to return such stop to its outer position, by swinging the lever 11 or 12 from "electrical" or "selective" to "safe" position.

In this instance a slide 50 replaces the dogs 5 and the slide 40 of the other form of our device. This slide extends from the quadrant 4 radially inward and has an aperture 51 in its inner end which encircles shaft 90, as shown in Figure 11. A slot in its radially outer end fits over a pin carried by a fixed bracket 52. Such slots merely serve as guides to control radial lengthwise movement of the slide. In a notch 53 in the outer end of lever 50 is engaged a knob on the end of a lever 54 pivoted by a pin 55. The opposite end of this lever is engaged with one leg of a leaf spring 56 of U shape, the other leg of which is pivoted by a pin 57 to the quadrant 4.

When slide 50 is in its outer or operative position the point of engagement between the end of spring 56 and the end of lever 54, as shown in Figure 10, is located eccentrically of the line joining pivots 55 and 57, at the side thereof such that the spring exerts a force on lever 54 in a direction to pry slide 50 outward by its engagement with notch 53. Normally, therefore, the slide is held in a position such that abutment 14 would engage its stop shoulder if one attempted to swing lever 11 or 12 beyond the "electrical" position toward "salvo" position. The force exerted through lever 54 by spring 56 is insufficient, however, to prevent radially inward movement of slide 50 by slight radial pressure on it. As the lever 11 is reciprocated lengthwise from the extended to the depressed position in Figure 11, when it is at the "electrical" location therefore, slide 50 will be shifted radially inward. Such movement also swings the end of lever 54 engaged with it in an inward direction and its other end outward. This outward swinging also rotates spring 56 by reason of its engagement with the lever end so that the point of the spring and lever engagement is now located at the opposite side of a line joining lever pivot 55 and spring pivot 57. In this position the spring exerts a force on the slide lever in a direction to hold slide 50 in its inner position, so that as lever 11 is withdrawn lengthwise into its extended position slide 50 will not follow.

The stop shoulder of slide 50 will thus be moved to inoperative position and held therein so that the lever 11, having been drawn lengthwise to extended position, may be swung from the "electrical" position on to the "salvo" position indicated in Figure 11. As previously described, movement of one lever to depressed position will similarly move all other levers so that the stop slide 50 of each will be held in its inner position by the respective springs 56. Not only may the levers be moved simultaneously from "electrical" position to "salvo" position, but they may be swung reversely back to "electrical" position past the retracted slides after all the bombs have been released.

As the lever 11 is moved from "electrical" position toward "safe" position when the slide 50 is still in its inner position the abutment 14 will ride upon the edge 58 of lever 54, forming an inclined wedging plane. As swinging of the lever 11 in such direction progresses, this edge of lever 54 will gradually be depressed to rotate the lever from the position of Figure 11 toward that of Figure 10, until, when lever 11 has passed the end of this inclined plane portion 58 of the lever edge, the point of engagement between spring 56 and the end of lever 54 will have been moved

to the opposite side of the line joining lever pivot 55 and spring pivot 57, at which side it was located originally. Simultaneously slide 50 will have been moved radially outward to some extent by swinging of the lever end engaged in its notch 53. The resilience of spring 56 will complete the rotation of lever 54 into the position of Figure 10 so that the slide will once more have been moved to its fully outward position, and thereafter it will be held in such position by the spring as previously explained.

Since the inclined surface 58 has thus been depressed below the edge of quadrant 4 on which abutment 14 rides, slide 50 will remain in its outer position during movement of control lever 11 or 12 from "safe" toward and into "electrical" position. The lever cannot be swung beyond slide 50 thus reset in its outer position, however, until after the control lever has again been reciprocated lengthwise to move the slide inwardly. Since the slide resetting mechanism is duplicated at all the other stations all the stop slides will be reset into their outer positions in the manner described as the operating levers are swung conjointly from "electrical" to "safe" position.

What we claim as our invention is:

1. Control mechanism comprising an operating handle, means supporting said handle for movement transversely of its length between two extreme positions, a stop member intermediate such extreme positions, engageable by said handle during movement thereof from an initial extreme position toward the other extreme position for interrupting such movement, means guiding said stop member for displacement into inoperative position out of the transverse movement path of said operating handle by movement of said handle in the direction of its length, and means operable to retain said stop member in its inoperative position to permit continued movement of the handle transversely of its length to such other extreme position.

2. Control mechanism comprising an operating handle, means supporting said handle for movement transversely of its length between two extreme positions, a stop member intermediate such extreme positions, engageable by said handle during movement thereof from an initial extreme position toward the other extreme position for interrupting such movement, means guiding said stop member for displacement into inoperative position out of the transverse movement path of said operating handle by movement of said handle in the direction of its length, means for retaining the stop member in its inoperative position, to permit continued movement of the handle transversely of its length to such other extreme position, until after the operating handle has been returned toward such initial extreme position past the location of the stop member, and means operable by movement of the operating handle from the location of the stop member toward such initial extreme position to effect return of the stop member into the transverse movement path of said operating handle.

3. Control mechanism comprising an operating handle, pivot means supporting said handle for swinging transversely of its length between two extreme positions, a stop member intermediate such extreme positions, engageable by said handle during movement thereof from an initial extreme position toward the other extreme position for interrupting such movement, means guiding said stop member for displacement toward said

handle pivot means into inoperative position out of the transverse swinging path of said operating handle, means supporting said handle for reciprocation toward its pivot means when in engagement with said stop member, thereby to displace said stop member into inoperative position, and means operable to retain said stop member in such inoperative position to permit swinging of said handle beyond the stop member location toward such other extreme position.

4. Control mechanism comprising an operating handle, pivot means supporting said handle for swinging transversely of its length between two extreme positions, a stop member intermediate such extreme positions, engageable by said handle during movement thereof from an initial extreme position toward the other extreme position for interrupting such movement, means guiding said stop member for displacement toward said handle pivot means into inoperative position out of the transverse swinging path of said operating handle, means supporting said handle for reciprocation toward its pivot means when in engagement with said stop member, thereby to displace said stop member into inoperative position, a lever engageable with said stop member, and spring means cooperating with said lever normally urging said stop member into the transverse swinging path of said operating handle, and further operable upon displacement of said stop member into inoperative position out of the transverse swinging path of said operating handle to retain said lever in such position to permit swinging of said handle beyond the stop member location toward such other extreme position, said lever being engageable by said operating handle during movement thereof between the stop member location and its initial extreme position to swing the lever for effecting return of said stop member from its inoperative position into the transverse swinging path of said operating handle.

5. Control mechanism comprising operating means at one location, an elongated member at a remote location, means supporting said elongated member for movement both transversely of its length and in the direction of its length, and two cables operatively interconnecting said operating means and said elongated member, said operating means being operable to effect lengthwise movement of said cables conjointly in the same direction to shift said elongated member transversely of its length, and said operating means further being operable to effect lengthwise movement of said cables conjointly in opposed directions to shift said elongated member in the direction of its length.

6. Control mechanism comprising an operating handle at one location, means supporting said handle for both swinging transversely of its length and for lengthwise reciprocation, a second control handle at a remote location, means supporting said second control handle for both swinging transversely of its length and for lengthwise reciprocation, and cables operatively interconnecting said two control handles, movable conjointly lengthwise in the same direction to effect such swinging of one of said control handles by swinging of the other control handle, and movable conjointly lengthwise in opposed directions to effect such reciprocation of one control handle by reciprocation of the other control handle.

7. Control mechanism comprising a pair of adjacent wheels pivoted coaxially for independent rotation, a control handle operatively connected with both of said wheels and reciprocable length-

wise generally radially of said wheels to rotate said wheels simultaneously in opposite directions, a second pair of adjacent wheels at a location remote from said first pair of wheels and pivoted coaxially for independent rotation, a control handle operatively connected with both wheels of said second pair and reciprocable lengthwise generally radially of said wheels by rotation of such wheels in opposite directions, and means interconnecting said two pairs of wheels operable to effect rotation of the wheels of said second pair in opposite directions in response to rotation of the wheels of said first pair in opposite directions by reciprocation of said first control handle, thereby to reciprocate said second control handle lengthwise corresponding to such reciprocation of said first control handle.

8. Control mechanism comprising a pair of adjacent wheels pivoted coaxially for independent rotation, a control handle operatively connected with both of said wheels and swingable transversely of its length to rotate at least one of said wheels and reciprocable lengthwise generally radially of said wheels to rotate said wheels simultaneously in opposite directions, a second pair of adjacent wheels at a location remote from said first pair of wheels and pivoted coaxially for independent rotation, a control member operatively connected with both wheels of said second pair swingable transversely of its length by rotation with one of such wheels and reciprocable lengthwise generally radially of said wheels by rotation of such wheels in opposite directions, and means interconnecting said two pairs of wheels operable to effect rotation of at least one wheel of said second pair and said control member in response to rotation of a wheel of said first pair by swinging of said control handle transversely of its length, and further operable to effect rotation of the wheels of said second pair in opposite directions in response to rotation of the wheels of said first pair in opposite directions by lengthwise reciprocation of said control handle, thereby to reciprocate said control member lengthwise corresponding to such reciprocation of said control handle.

9. Control mechanism comprising a wheel, a control handle operatively connected with said wheel to rotate it conjointly with said handle, and further to rotate said wheel by movement of said control handle relative thereto in a direction generally radially thereof, a second wheel at a location remote from said first wheel, means operable to rotate said second wheel correspondingly by rotation of said first wheel, a control member operatively connected with said second wheel to be rotated thereby and conjointly therewith by rotation of said control handle, and means operable to effect movement of said control member generally radially of said second wheel upon rotation thereof effected by movement of said control handle generally radially of said first wheel.

10. Control mechanism comprising a control handle, a wheel at a location remote from said control handle, means operable by said control handle to rotate said wheel, a control arm operatively connected to said wheel for rotation therewith, and also, by relative rotation of said wheel and arm, for lengthwise reciprocation of said arm relative to said wheel and generally radially thereof, and means cooperating with said control arm for restraining conjoint rotation of said arm with said wheel by movement of said control

handle, to effect lengthwise reciprocation of said arm relative to said wheel.

11. In combination with an actuator rotatable from a "safe" position through a "selective" position to a "salvo" position to condition a bomb rack for release, interconnected mechanism at each of several stations, such as a bombardier's and a pilot's station, to effect such rotation, said mechanism comprising an operating lever at one station mounted for rotation concentrically with and operatively connected to rotate the actuator, and for reciprocation relatively to the axis of rotation, a similarly rotatable and reciprocable lever at each other station, intercepting means at each station, at the "selective" position, to intercept rotation of the lever, each of said intercepting means being passable by its lever only after reciprocation of said intercepting means by reciprocatory movement of its said lever, and rotary means interconnecting the levers at each station operable to transmit both rotative and reciprocatory movement of one lever to all other levers.

12. In combination with an actuator rotatable from a "safe" position through a "selective" position to a "salvo" position to condition a bomb rack for release, interconnected mechanism at each of several stations, such as a bombardier's and a pilot's station, to effect such rotation, said mechanism comprising an operating lever at one station mounted for rotation concentrically with and operatively connected to rotate the actuator, and slotted for reciprocation transversely of the axis of rotation, a similarly slotted lever rotatable and reciprocable at each other station, intercepting means at each station, at the "selective" position, to intercept rotation of its lever, each of said intercepting means being passable by its lever only after reciprocation of said intercepting means to inoperative position by reciprocatory movement of its said lever, operating means at each station connected to its own lever for rotation by such transverse reciprocation of such lever, or to effect such reciprocation of its lever when said operating means is rotated, and transmission means interconnecting each such operating means with corresponding operating means at each other station, to effect identical rotational and reciprocatory movement of all said levers when any one thereof is moved.

13. In combination with an actuator rotatable from a "safe" position through a "selective" position to a "salvo" position to condition a bomb rack for release, interconnected mechanism at each of several stations, such as a bombardier's and a pilot's station, to effect such rotation, said mechanism comprising an operating lever at one station mounted for rotation concentrically with and operatively connected, outwardly of the axis of rotation, with the actuator, for rotation of the latter, said lever being slotted at the axis and in its connection to the actuator, for reciprocation transversely of the axis of rotation, a similar lever rotatable at each station, and slotted for reciprocation relative to its axis of rotation, intercepting means at each station to intercept rotation of its lever at the "selective" position, each of said intercepting means being passable by its lever only after reciprocation of said intercepting means to inoperative position by reciprocatory movement of its lever, operating means at each station connected to its own lever, outwardly of the axis of rotation, for limited rota-

tion about such axis by such transverse reciprocation of such lever, or to effect such reciprocation of its lever when said operating means is otherwise rotated, and transmission means interconnecting each such operating means with corresponding operating means at each other station, to effect identical rotation of one such means when any other such means is rotated, whether by reciprocatory or rotational movement of a lever.

14. In combination, a shaft, an actuator member rotatable thereabout from a "safe" position through a "selective" position to a "salvo" position to condition a bomb rack for release, and interconnected mechanism at each of two stations, such as a bombardier's station and a pilot's station, to effect such rotation, said mechanism comprising an operating lever member at one station slotted to receive the actuator member shaft, a pin outwardly of the shaft's axis, the pin being received in one of said members, and the other of said members being slotted parallel to the lever member's shaft receiving slot, whereby the lever member may reciprocate relatively to the actuator member, and the two members will rotate conjointly, a similar slotted operating lever member at the other station, a shaft received in such slot, a quadrant at each station guiding said lever members, respectively, for rotary movement in a fixed path, a stop upstanding in the path of each such lever member at the "selective" position to block its further rotation, each stop being mounted for movement from such blocking position by inward movement of its lever, member, two pulleys freely rotatable about the shaft at each station, and each having a pin connection eccentrically of its shaft to the lever member at its station, the pin connections to the two pulleys at each station being at opposite sides of the shaft for reversed rotational movement of the pulleys by a given transverse movement of the lever, and cables connecting like pulleys at the two stations for corresponding movement.

15. In combination, a shaft, an actuator thereon rotatable from a "safe" position through a "selective" position to a "salvo" position to condition a bomb rack for release, and interconnected mechanism at each of several stations, such as a bombardier's and a pilot's station, to effect such rotation, said mechanism comprising an operating lever at one station mounted for rotation concentrically with and operatively connected to rotate the actuator, and slotted to straddle the shaft for reciprocation transversely of the axis of rotation, a shaft and a similarly rotatable and reciprocable lever at each other station, a quadrant at each station permitting rotation of its lever only when its slot is bottomed upon its shaft, a stop in the "selective" position at each station, upstanding to block movement of the lever towards "salvo" position, and a guide for said stop guiding it for radial inward movement by depression of the lever, transversely of the shaft, and means interconnecting the levers at each station to transmit identical rotative and transverse movement of any one lever to all other such levers.

16. The combination of claim 15, including a dog at each station engageable with the stop, to hold the stop depressed, and thus to enable movement of the lever to "salvo" position.

DELBERT S. LEWIS.  
ERVING F. LEWIS.